

The foraging behaviour of the Scaly-sided Merganser *Mergus squamatus* in the Changbai Mountains and Xiao Xingangling Mountains of China

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The Scaly-sided Merganser *Mergus squamatus* breeds mainly in the Changbai Mountains and Xiao Xingangling Mountains of China, and in some areas in the Far East of Russia. It is an endangered species with a restricted distribution and a small population. It is a category 1 protected species in China and is globally threatened and declining (Collar *et al.* 1994). Consequently it has considerable conservation importance. In China, there have been few previous studies of the biology of the Scaly-sided Merganser (Zhao *et al.*, 1979, 1985, 1994a, 1994b) although some more detailed work has recently been published from Russia (Bocharnikov and Shibnyez 1994, Surmach and Zaykin 1994, Yelsukov 1994).

The ecology of the Scaly-sided Merganser was studied from 1985 to 1989 on the Todaobaihe River in the Changbai Mountains, Jilin Province, and from 1994 to 1995 on the Yong Cui River in the Xiao Xingangling Mountains, Heilongjiang Province of China. The Todaobaihe River flows through an area of primary forest in which large oaks *Quercus dentata* and poplars *Populus ussuriensis* provide suitable nest holes for the merganser. The river is slow-flowing and meandering, with a rocky gravel bed. The river is rich in fish, shrimps, crayfish *Astacus* and aquatic insects, thus providing a good feeding habitat for the Scaly-sided Merganser. The Yong Cui River is very similar to the Todaobaihe River, although only small patches of primary forest still remain along its banks.

Scaly-sided Mergansers arrive in the Changbai Mountains in early March and remain until the end of October. Throughout this period they feed in the rivers and streams of mixed coniferous/broad-leaved forests

below 900 m asl. Preferred feeding sites change during the breeding season. Immediately upon arrival in the Changbai Mountains and prior to their departure, the mergansers forage in larger rivers without wooded banks (including the downstream sections of the same rivers where breeding occurs). Between April and September, they feed in forested rivers, for example the Todaobaihe River and its tributaries. From October to March they forage in larger rivers without wooded banks. Food species taken by the Scaly-sided Merganser include stoneflies Plecoptera, caddisflies Phryganeidae, beetles Coleoptera, Lamprey *Lampetra morii*, Loach *Misgurnus anguillicaudatus*, Lenok *Brachymystax lenok*, Culpin *Mesocottus haitej*, Grayling *Thymallus arcticus* and crayfish, which live in gravel among rocks on the river bed. The Scaly-sided Merganser's bill is long, thin and hooked at the tip with many serrations which make it specially adapted for catching prey in this situation. Caddisfly larvae and small fish are the major prey items (Table 1), and are the most abundant aquatic animals of the Todaobaihe and the Yong Cui rivers, providing adequate food resources for the birds. The diet of the Scaly-sided Merganser changes slightly during the summer. Caddisfly larvae are most abundant during June to July, when they constitute about 90% of their diet. Adult emergence of caddisflies occurs in August at which time the birds change their diet to feed on small fish, shrimps and crayfish. In September the main prey item of the mergansers changes again to fish fry, which become more abundant at this time of year. Thus it is apparent that the Scaly-sided Merganser is an opportunist feeder, selecting the most abundant food source (Table 1).

Table 1. Composition of stomachs of Scaly-sided Merganser *Mergus squamatus*

Food	April – May (n=2)		June – July (n=5)		August – September (n=4)	
	Number of birds	Stomach content (%)	Number of birds	Stomach content (%)	Number of birds	Stomach content (%)
Caddisfly larvae	2	>70	5	>70	3	>70
Stoneflies	2	50-70	5	>70	2	30-50
Beetles	1	<30	1	50-70	1	<30
Crayfish	1	<30	3	30-50	2	50-70
Shrimps	1	<30	0		2	50-70
Lamprey	2	<30	0		0	
Loach	1	30-50	3	50-70	3	>70
Lenok	1	30-50	4	50-70	3	50-70
Sculpin	0		2	30-50	1	<30
Other fish	0		3	30-50	3	>70

Stomachs were collected by us from 11 adults Scaly-sided Merganser during April to September, 1962-1978, in the Changbai Mountains. Stomach content (%) indicates the percentage of food content made up of each prey item.

During the breeding season, the Scaly-sided Merganser has little competition for food on the Todaobaihe River. Competition between Scaly-sided Merganser and Mandarin Duck *Aix galericulata* has not been observed. Mandarin Ducks breed on the same river systems as the mergansers, with sometimes as little as 50 m between nest sites. At this time both the mergansers and the Mandarins forage in the same areas and both take shrimps and caddisfly larvae as part of their diet. However, other factors must operate to reduce competition between them. Obvious differences in feeding technique and an abundance of caddisfly larvae reduces competition. During the non-breeding period Scaly-sided Mergansers may compete for food with Common Merganser *Mergus merganser*, Red-breasted Merganser *M. serrator* and Common Goldeneye *Bucephala clangula*, which also inhabit the large, non-wooded rivers such as the Yalu and Tumen.

The foraging method employed by the Scaly-sided Merganser varies according to the depth of water. In shallow water, it usually immerses only its head, while in deeper water it dives for food. Dive times range from 15 to 30 seconds with associated interdive intervals of 3-5 seconds. Scaly-sided Mergansers usually hunt for food in shallow water close to the river bank, probably because food resources are more abundant there. During the breeding season, they tend to feed more in these shallow areas, whereas during the non-breeding period, on larger, deeper rivers they must feed more by diving. Whatever the feeding site, they always feed into the current, in order to take advantage of the clearer water upstream of their foraging activities. They also tend to fly upstream when threatened (except during migration), being extremely vigilant at all times. At any sign of danger they assume alert postures or conceal themselves in riverside vegetation. When disturbed they fly directly upstream away from the disturbance. Even moulting or unfledged juveniles escape against the current. We suggest that this behaviour of juveniles escaping upstream is restricted to the foraging direction. In the breeding season, the Scaly-sided Merganser spends most of the day feeding. Foraging behaviour may occur for a period of 14-15 hours per day, from first light at 03h00 until dusk at 19h00. Foraging activity is usually interspersed with shorter periods of loafing, preening or bathing. Preening includes wing-flapping behaviour, in which birds raise themselves from the water surface and stretch their necks vertically before flapping their wings. Once satiated, Scaly-sided Mergansers form groups of birds on the margins of the river where they sleep, preen and loaf. There is also a small amount of aggressive or social interaction. Most of this communal behaviour occurs between 12h00 and 13h00 and in the evening. At night, the Mergansers roost together in vegetation on the riverbank.

Scaly-sided Mergansers usually forage singly or in small groups of 2-3 birds. Even when the foraging area is relatively small, birds tend to disperse to feed. It is rare to see more than 10 birds feeding together except during migration. The largest group of feeding birds which we observed was during migration in October

1989. They have been seen foraging in the same areas as Mandarin Ducks, Mallard *Anas platyrhynchos*, Common Goldeneyes and Common Mergansers, but rarely in close proximity. Similarly, Scaly-sided Mergansers tend to remain on the edge of flocks of other species. We suggest that their habit of feeding in dispersed groups, contrasting with communal loafing, is beneficial in that it reduces competition for food resources while increasing group vigilance during loafing. There may be two reasons for foraging in small groups; firstly, as a result of the dispersed nature of the Scaly-sided Merganser's distribution and, secondly, due to a limited food supply. Food analysis has suggested that the Scaly-sided Merganser is a relatively specialized feeder in terms of preferred prey and feeding site. It usually selects rivers with gravel-covered beds and feeds mainly on benthic organisms, especially during the breeding season. The available food resources are limited within a given feeding area. In consequence, it must feed in small groups. Our observations of this habit of dispersed feeding agrees with the observation of Pulliman and Caraco (1984) that large foraging groups only occur when food resources are abundant. We suggest that this is probably the reason for the dispersed distribution of the Scaly-sided Merganser.

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